

10/52/138

SEQUENCE LISTING

<110> Johnson, Karl F.
Bezila, Daniel James
Taylor, Diane E.
Simala-Grant, Joanne
Rasko, David
Neose Technologies, Inc.
Governors of the University of Alberta

<120> Synthesis of Oligosaccharides, Glycolipids and
Glycoproteins Using Bacterial Glycosyltransferases

<130> 019957-015920US

<140> US 11/521,138

<141> 2005-01-11

<150> US 60/398,156

<151> 2002-07-23

<150> US 60/424,894

<151> 2002-11-08

<150> WO PCT/US03/23057

<151> 2003-07-23

<150> WO PCT/US03/23155

<151> 2003-07-23

<160> 76

<170> PatentIn Ver. 2.1

<210> 1

<211> 1461

<212> DNA

<213> Helicobacter pylori

<220>

<223> Helicobacter pylori strain 1182 FutB
alpha-1,3/4-fucosyltransferase

<400> 1

atgttccaac	ccctattaga	cgcttatata	gaaagcgctt	ccattgaaaa	aattacctct	60
aaatctcccc	ccccctaaa	aatcgctgtg	gcgaattggg	ggggagatga	agagggttgaa	120
gaatttaaaa	agaacattct	ttattttatt	ctcagtcagc	attacacaat	caccctccac	180
caaaacccca	acgaaccctc	cgatctcgtc	tttggcagtc	ctattggatc	agccagaaaa	240
atcttatcct	atcaaaaacgc	aaaaagagtg	ttttacaccg	gtgaaaaacga	atcgccctaat	300
ttcaacctct	ttgattacgc	cataggcttt	gatgaattgg	attttagaga	tcgttattta	360
agaatgcctt	tatattatga	tagactacac	cataaagccg	agagcgtgaa	tgacaccact	420
tcgccttaca	aactcaaacc	tgacagcctt	tatgctttta	aaaaaccctc	ccatcatttt	480
aaagaaaacc	acccaatttt	atgcgcagta	gtgaacaatg	agagcgatcc	tttgaaaaga	540
ggggtttgca	gttttgtagc	gagcaaccct	aacgctccta	aaaggaatgc	tttctatgac	600
gtttttaaat	ctatagagcc	agttattggg	ggagggagcg	tgaaaaaacac	tttaggctat	660
aacattaaaa	acaagagcga	gtttttaagc	caatacaaat	tcaatctgtg	ttttgaaaac	720
tcacaaggct	atggctatgt	aactgaaaaa	atcattgacg	cttacttttag	ccataccatt	780
ccattttatt	gggggagtc	tagcgtggca	caagatttta	accctaagag	ttttgtgaat	840
gtttgtgatt	ttaaagattt	tgatgaagcg	attgatcatg	tgcgatactt	gcacacgcac	900
ccaaacgctt	atttagacat	gctttatgaa	aaccctttta	acacccttga	tgggaaagct	960
tacttttacc	aaaatttgag	ttttaaaaaa	atcctagatt	tttttaaaac	gatttttagaa	1020

```

aacgacacga tttatcacga taaccctttt atttttttatc gtgatttgaa tgagccgtta 1080
atatctattg atgatgattt gaggggttaat tatgatgatt tgaggggttaa ttatgatgat 1140
ttgaggggta attatgatga tttgaggggtt aattatgatg atttgaggggt taattatgat 1200
gatttgaggg ttaattatga tgatttgagg gttaattatg atgatttgag ggttaattat 1260
gatgatttga ggggttaatta tgatgatttg aggggttaatt atgatgattt gaggggttaat 1320
tatgagcggc tcttacaaaa cgcctcgcct ttattagaac tctctcaaaa caccactttt 1380
aaaatctatc gcaaagctta tcaaaaatcc ttacctttgt tgcgtgcggc gagaaagttg 1440
attaaaaaat tgggtttgta a 1461

```

```

<210> 2
<211> 486
<212> PRT
<213> Helicobacter pylori

```

```

<220>
<223> Helicobacter pylori strain 1182 FutB
      alpha-1,3/4-fucosyltransferase

```

```

<400> 2
Met Phe Gln Pro Leu Leu Asp Ala Tyr Ile Glu Ser Ala Ser Ile Glu
  1             5             10             15

Lys Ile Thr Ser Lys Ser Pro Pro Pro Leu Lys Ile Ala Val Ala Asn
      20             25             30

Trp Trp Gly Asp Glu Glu Val Glu Glu Phe Lys Lys Asn Ile Leu Tyr
      35             40             45

Phe Ile Leu Ser Gln His Tyr Thr Ile Thr Leu His Gln Asn Pro Asn
      50             55             60

Glu Pro Ser Asp Leu Val Phe Gly Ser Pro Ile Gly Ser Ala Arg Lys
      65             70             75             80

Ile Leu Ser Tyr Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn
      85             90             95

Glu Ser Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu
      100            105            110

Leu Asp Phe Arg Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr Asp Arg
      115            120            125

Leu His His Lys Ala Glu Ser Val Asn Asp Thr Thr Ser Pro Tyr Lys
      130            135            140

Leu Lys Pro Asp Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His Phe
      145            150            155            160

Lys Glu Asn His Pro Asn Leu Cys Ala Val Val Asn Asn Glu Ser Asp
      165            170            175

Pro Leu Lys Arg Gly Phe Ala Ser Phe Val Ala Ser Asn Pro Asn Ala
      180            185            190

Pro Lys Arg Asn Ala Phe Tyr Asp Val Leu Asn Ser Ile Glu Pro Val
      195            200            205

Ile Gly Gly Gly Ser Val Lys Asn Thr Leu Gly Tyr Asn Ile Lys Asn
      210            215            220

```

Lys Ser Glu Phe Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu Asn
 225 230 235 240
 Ser Gln Gly Tyr Gly Tyr Val Thr Glu Lys Ile Ile Asp Ala Tyr Phe
 245 250 255
 Ser His Thr Ile Pro Ile Tyr Trp Gly Ser Pro Ser Val Ala Gln Asp
 260 265 270
 Phe Asn Pro Lys Ser Phe Val Asn Val Cys Asp Phe Lys Asp Phe Asp
 275 280 285
 Glu Ala Ile Asp His Val Arg Tyr Leu His Thr His Pro Asn Ala Tyr
 290 295 300
 Leu Asp Met Leu Tyr Glu Asn Pro Leu Asn Thr Leu Asp Gly Lys Ala
 305 310 315 320
 Tyr Phe Tyr Gln Asn Leu Ser Phe Lys Lys Ile Leu Asp Phe Phe Lys
 325 330 335
 Thr Ile Leu Glu Asn Asp Thr Ile Tyr His Asp Asn Pro Phe Ile Phe
 340 345 350
 Tyr Arg Asp Leu Asn Glu Pro Leu Ile Ser Ile Asp Asp Asp Leu Arg
 355 360 365
 Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn
 370 375 380
 Tyr Asp Asp Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp
 385 390 395 400
 Asp Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp Asp Leu
 405 410 415
 Arg Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp Asp Leu Arg Val
 420 425 430
 Asn Tyr Asp Asp Leu Arg Val Asn Tyr Glu Arg Leu Leu Gln Asn Ala
 435 440 445
 Ser Pro Leu Leu Glu Leu Ser Gln Asn Thr Thr Phe Lys Ile Tyr Arg
 450 455 460
 Lys Ala Tyr Gln Lys Ser Leu Pro Leu Leu Arg Ala Ala Arg Lys Leu
 465 470 475 480
 Ile Lys Lys Leu Gly Leu
 485

<210> 3

<211> 1299

<212> DNA

<213> *Helicobacter pylori*

<220>

<223> *Helicobacter pylori* strain 1111 FutA
 alpha-1,3/4-fucosyltransferase

```

<400> 3
atgttccaac ccctattaga tgcctttata gaaagcgctc cattgaaaaa atggcctcta 60
aatctcccc ccctaaaaat cgctgtggcg aattgggtggg gagatgaaga aattaaaaaa 120
tttaaaaaga gcgttcttta ttttatccta agccagcatt acacaatcac ttacaccga 180
aaccttgata aacctgcgga catcgtcttt ggtaaccccc ttggatcagc cagaaaaatc 240
ttatcctatc aaaacgcaaa aagggtgttt tacaccggtg aaaatgaagt ccctaacttc 300
aacctctttg attacgccat aggcctttgat gaattggact ttagagatcg ttatttgaga 360
atgcctttgt attatgccta tttgcattat aaagccgagc ttgttaatga caccacttcg 420
ccttataaac tccaacctga cagcctttat gctttaaaaa aacctccca tcatttttaa 480
gaaaaccacc ccaattttgtg cgcagtagtg aataatgaga gtgatccttt gaaaagaggg 540
tttgcgagct ttgtcgcaag caaccctaac gctcctagaa ggaacgcttt ttatgaggct 600
ttaaagccta ttgagccagt tgctggggga gggagcgtga aaaacacttt aggctataat 660
gtcaaaaaca agagcgagtt tttaagccaa tacaattca atctgtgttt tgaaaacact 720
caaggctatg gctatgtaac tgaaaagatc attgacgctt atttcagcca taccattcct 780
atattattggg ggagtccag cgtggcgaaa gattttaacc ctaagagttt tgtgaatgtc 840
catgatttca acaactttga tgaagcgatt gactatatca gatacttgca cacgcacca 900
aacgcttatt tagacatgca ctatgaaaac cctttaaaca ctattgatgg gaaagcttac 960
ttttaccaa atttgagttt taaaaaaatc ctagattttt ttaaaacgat tttagaaaac 1020
gacacgatct atcacgataa ccctttcatt ttctatcgtg atttgaatga gccttcagta 1080
tctattgatg gtttgagggg taattatgat gatttgaggg ttaattatga tgatttgagg 1140
gttaattatg atgatttgag ggtaattat gagcgccttt tacaaaacgc ctgccttta 1200
ttagaactct ctcaaaacac cacttttaaa atctatcgca aagcttatca aaaatccttg 1260
cctttgttgc gtgccataag gagatggggt aaaaagtaa 1299

```

```

<210> 4
<211> 432
<212> PRT
<213> Helicobacter pylori

```

```

<220>
<223> Helicobacter pylori strain 1111 FutA
alpha-1,3/4-fucosyltransferase

```

```

<400> 4
Met Phe Gln Pro Leu Leu Asp Ala Phe Ile Glu Ser Ala Pro Leu Lys
  1             5             10             15

Lys Trp Pro Leu Asn Leu Pro Pro Leu Lys Ile Ala Val Ala Asn Trp
          20             25             30

Trp Gly Asp Glu Glu Ile Lys Lys Phe Lys Lys Ser Val Leu Tyr Phe
          35             40             45

Ile Leu Ser Gln His Tyr Thr Ile Thr Leu His Arg Asn Pro Asp Lys
          50             55             60

Pro Ala Asp Ile Val Phe Gly Asn Pro Leu Gly Ser Ala Arg Lys Ile
          65             70             75             80

Leu Ser Tyr Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn Glu
          85             90             95

Val Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu Leu
          100            105            110

Asp Phe Arg Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr Ala Tyr Leu
          115            120            125

His Tyr Lys Ala Glu Leu Val Asn Asp Thr Thr Ser Pro Tyr Lys Leu
          130            135            140

```

Gln	Pro	Asp	Ser	Leu	Tyr	Ala	Leu	Lys	Lys	Pro	Ser	His	His	Phe	Lys	145	150	155	160
Glu	Asn	His	Pro	Asn	Leu	Cys	Ala	Val	Val	Asn	Asn	Glu	Ser	Asp	Pro	165	170		175
Leu	Lys	Arg	Gly	Phe	Ala	Ser	Phe	Val	Ala	Ser	Asn	Pro	Asn	Ala	Pro	180	185		190
Arg	Arg	Asn	Ala	Phe	Tyr	Glu	Ala	Leu	Asn	Ala	Ile	Glu	Pro	Val	Ala	195	200		205
Gly	Gly	Gly	Ser	Val	Lys	Asn	Thr	Leu	Gly	Tyr	Asn	Val	Lys	Asn	Lys	210	215		220
Ser	Glu	Phe	Leu	Ser	Gln	Tyr	Lys	Phe	Asn	Leu	Cys	Phe	Glu	Asn	Thr	225	230		235
Gln	Gly	Tyr	Gly	Tyr	Val	Thr	Glu	Lys	Ile	Ile	Asp	Ala	Tyr	Phe	Ser	245	250		255
His	Thr	Ile	Pro	Ile	Tyr	Trp	Gly	Ser	Pro	Ser	Val	Ala	Lys	Asp	Phe	260	265		270
Asn	Pro	Lys	Ser	Phe	Val	Asn	Val	His	Asp	Phe	Asn	Asn	Phe	Asp	Glu	275	280		285
Ala	Ile	Asp	Tyr	Ile	Arg	Tyr	Leu	His	Thr	His	Pro	Asn	Ala	Tyr	Leu	290	295		300
Asp	Met	His	Tyr	Glu	Asn	Pro	Leu	Asn	Thr	Ile	Asp	Gly	Lys	Ala	Tyr	305	310		315
Phe	Tyr	Gln	Asn	Leu	Ser	Phe	Lys	Lys	Ile	Leu	Asp	Phe	Phe	Lys	Thr	325	330		335
Ile	Leu	Glu	Asn	Asp	Thr	Ile	Tyr	His	Asp	Asn	Pro	Phe	Ile	Phe	Tyr	340	345		350
Arg	Asp	Leu	Asn	Glu	Pro	Ser	Val	Ser	Ile	Asp	Gly	Leu	Arg	Val	Asn	355	360		365
Tyr	Asp	Asp	Leu	Arg	Val	Asn	Tyr	Asp	Asp	Leu	Arg	Val	Asn	Tyr	Asp	370	375		380
Asp	Leu	Arg	Val	Asn	Tyr	Glu	Arg	Leu	Leu	Gln	Asn	Ala	Ser	Pro	Leu	385	390		395
Leu	Glu	Leu	Ser	Gln	Asn	Thr	Thr	Phe	Lys	Ile	Tyr	Arg	Lys	Ala	Tyr	405	410		415
Gln	Lys	Ser	Leu	Pro	Leu	Leu	Arg	Ala	Ile	Arg	Arg	Trp	Val	Lys	Lys	420	425		430

<210> 5

<211> 1458

<212> DNA

<213> *Helicobacter pylori*

<220>

<223> Helicobacter pylori strain 1218 FutB
alpha-1,3/4-fucosyltransferase

<400> 5

```
atgttccaac ccctattaga cgcttatata gaaagcgctt ccattgaaaa aattacctct 60
aaatctcccc cccccctaaa aatcgctgtg gcgaattggt ggggagatga agagggtgaa 120
gaatttaaaa agaacattct ttattttatt ctcagtcagc attacacaat caccctccac 180
caaaacccca acgaaccctc cgatctcgtc tttggcagtc ctattggatc agccagaaaa 240
atcttatcct atcaaaacgc aaaaagagtg ttttacaccg gtgaaaacga atcgccctaat 300
ttcaacctct ttgattacgc cataggcttt gatgaattgg attttagaga tcggtattta 360
agaatgcctt tatattatga tagactacac cataaagccg agagcgtgaa tgacaccact 420
tcgccttaca aactcaaacc tgacagcctt tatgctttta aaaaaccctc ccatcatttt 480
aaagaaaacc accccaattt atgcgcagta gtgaacaatg agagcgcgatcc tttgaaaaga 540
gggtttgcca gttttgtagc gagcaaccct aacgctccta aaaggaatgc tttctatgac 600
gcttttaatt ctatagagcc agttattggg ggagggagcg tgaaaaacac tttaggctat 660
aacattaaaa acaagagcga gtttttaagc caatacaaat tcaatctgtg ttttgaaaac 720
tcacaaggct atggctatgt aactgaaaaa atcattgacg cttacttttag ccataccatt 780
cctatatttatt gggggagtcct tagcgtggca caagatttta accctaagag ttttgtgaat 840
gtttgtgatt ttaaagattt tgatgaagcg attgatcatg tgcgatactt gcacacgcac 900
ccaaacgctt atttagacat gctttatgaa aaccctttta acacccttga tgggaaagct 960
tactttttacc aaaatttgag ttttaaaaaa atcctagatt tttttaaaac gatccttagaa 1020
aacgacacga tttatcacga taaccctttt attttttatc gtgatttgaa tgagccgta 1080
atatctattg atgatttgag ggtaattat gatgatttga gggtaatta tgatgatttg 1140
agggttaatt atgatgattt gagggtaatt tatgatgatt tgaggggttaa ttatgatgat 1200
ttgaggggta attatgatga tttgaggggt aattatgatg atttgaggggt taattatgat 1260
gatttgaggg ttaattgtga tgatttgagg gtttaattatg atgatttgag ggtaattat 1320
gagcggctct tacaaaacgc ctgcctttta ttagaactct ctcaaaaacac cactttttaa 1380
atctatcgca aagcttatca aaaatcctta cctttgttgc gtgcggcgag aaagttgatt 1440
aaaaaattgg gtttgtaa 1458
```

<210> 6

<211> 485

<212> PRT

<213> Helicobacter pylori

<220>

<223> Helicobacter pylori strain 1218 FutB
alpha-1,3/4-fucosyltransferase

<400> 6

```
Met Phe Gln Pro Leu Leu Asp Ala Tyr Ile Glu Ser Ala Ser Ile Glu
  1                      5                      10                     15

Lys Ile Thr Ser Lys Ser Pro Pro Pro Leu Lys Ile Ala Val Ala Asn
          20                      25                     30

Trp Trp Gly Asp Glu Glu Val Glu Glu Phe Lys Lys Asn Ile Leu Tyr
          35                      40                     45

Phe Ile Leu Ser Gln His Tyr Thr Ile Thr Leu His Gln Asn Pro Asn
          50                      55                     60

Glu Pro Ser Asp Leu Val Phe Gly Ser Pro Ile Gly Ser Ala Arg Lys
          65                      70                     75                     80

Ile Leu Ser Tyr Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn
          85                      90                     95
```

Glu	Ser	Pro	Asn	Phe	Asn	Leu	Phe	Asp	Tyr	Ala	Ile	Gly	Phe	Asp	Glu	
			100					105					110			
Leu	Asp	Phe	Arg	Asp	Arg	Tyr	Leu	Arg	Met	Pro	Leu	Tyr	Tyr	Asp	Arg	
		115					120					125				
Leu	His	His	Lys	Ala	Glu	Ser	Val	Asn	Asp	Thr	Thr	Ser	Pro	Tyr	Lys	
	130					135					140					
Leu	Lys	Pro	Asp	Ser	Leu	Tyr	Ala	Leu	Lys	Lys	Pro	Ser	His	His	Phe	
145					150					155					160	
Lys	Glu	Asn	His	Pro	Asn	Leu	Cys	Ala	Val	Val	Asn	Asn	Glu	Ser	Asp	
			165						170					175		
Pro	Leu	Lys	Arg	Gly	Phe	Ala	Ser	Phe	Val	Ala	Ser	Asn	Pro	Asn	Ala	
			180					185					190			
Pro	Lys	Arg	Asn	Ala	Phe	Tyr	Asp	Ala	Leu	Asn	Ser	Ile	Glu	Pro	Val	
		195					200					205				
Ile	Gly	Gly	Gly	Ser	Val	Lys	Asn	Thr	Leu	Gly	Tyr	Asn	Ile	Lys	Asn	
	210					215					220					
Lys	Ser	Glu	Phe	Leu	Ser	Gln	Tyr	Lys	Phe	Asn	Leu	Cys	Phe	Glu	Asn	
225					230					235					240	
Ser	Gln	Gly	Tyr	Gly	Tyr	Val	Thr	Glu	Lys	Ile	Ile	Asp	Ala	Tyr	Phe	
				245					250					255		
Ser	His	Thr	Ile	Pro	Ile	Tyr	Trp	Gly	Ser	Pro	Ser	Val	Ala	Gln	Asp	
			260					265					270			
Phe	Asn	Pro	Lys	Ser	Phe	Val	Asn	Val	Cys	Asp	Phe	Lys	Asp	Phe	Asp	
		275					280					285				
Glu	Ala	Ile	Asp	His	Val	Arg	Tyr	Leu	His	Thr	His	Pro	Asn	Ala	Tyr	
	290					295					300					
Leu	Asp	Met	Leu	Tyr	Glu	Asn	Pro	Leu	Asn	Thr	Leu	Asp	Gly	Lys	Ala	
305					310					315					320	
Tyr	Phe	Tyr	Gln	Asn	Leu	Ser	Phe	Lys	Lys	Ile	Leu	Asp	Phe	Phe	Lys	
				325					330					335		
Thr	Ile	Leu	Glu	Asn	Asp	Thr	Ile	Tyr	His	Asp	Asn	Pro	Phe	Ile	Phe	
			340					345					350			
Tyr	Arg	Asp	Leu	Asn	Glu	Pro	Leu	Ile	Ser	Ile	Asp	Asp	Leu	Arg	Val	
		355					360					365				
Asn	Tyr	Asp	Asp	Leu	Arg	Val	Asn	Tyr	Asp	Asp	Leu	Arg	Val	Asn	Tyr	
	370					375					380					
Asp	Asp	Leu	Arg	Val	Asn	Tyr	Asp	Asp	Leu	Arg	Val	Asn	Tyr	Asp	Asp	
385					390					395					400	
Leu	Arg	Val	Asn	Tyr	Asp	Asp	Leu	Arg	Val	Asn	Tyr	Asp	Asp	Leu	Arg	
			405					410						415		

Val Asn Tyr Asp Asp Leu Arg Val Asn Cys Asp Asp Leu Arg Val Asn
420 425 430

Tyr Asp Asp Leu Arg Val Asn Tyr Glu Arg Leu Leu Gln Asn Ala Ser
435 440 445

Pro Leu Leu Glu Leu Ser Gln Asn Thr Thr Phe Lys Ile Tyr Arg Lys
450 455 460

Ala Tyr Gln Lys Ser Leu Pro Leu Leu Arg Ala Ala Arg Lys Leu Ile
465 470 475 480

Lys Lys Leu Gly Leu
485

<210> 7
<211> 831
<212> DNA
<213> Helicobacter pylori

<220>
<223> Helicobacter pylori strain 19C2 FutB
alpha-1,3/4-fucosyltransferase

<400> 7
atgttccaac ccctattaga cgcttatata gacagcaccc gtttagatga aaccgattat 60
aagcccccat taaatatagc cctagcgaat tgggtggcctt tggataaaaag agaaagcaaa 120
ggggtttagaa aaaaatttat cttacatttc attttaagtc agcattacac aatcgctctc 180
caccgaaacc ctgataaacc tgcggacatc gtttttggtta acccccttgg atcagccaga 240
aaaatcctat cctatcaaaa cgctaaaagg gtgttttaca ccggtgaaaa cgaagtccct 300
aatttcaacc tctttgatta cgccataggc tttgatgaat tggacttttag agatcgttat 360
ttgagaatgc ctttatatta tgatagacta caccataaag ccgagagcgt gaatgacacc 420
accgcacctt acaagattaa atctgacagc ctttatgctt taaaaaagcc ctcccatcat 480
tttaaagaaa accaccaca tttatgcgcg ctaatcaata atgagatcga tcctttgaaa 540
agaggggttg cgagctttgt cgcaagcaac cctaacgccc ctataaggaa cgctttctat 600
gaggctttta attctattga gccagttact gggggaggga gcgtgagaaa cacttttaggc 660
tataacgtca aaaacaaaaa cgaatttttg agccaatata agttcaatct gtgctttgaa 720
aacactcaag gctatggcta tgttactgaa aaaatcattg acgcttactt cagccacacc 780
attcctatatt attggggggg agtccctagc gtggcgaaaag attttaacc c 831

<210> 8
<211> 277
<212> PRT
<213> Helicobacter pylori

<220>
<223> Helicobacter pylori strain 19C2 FutB
alpha-1,3/4-fucosyltransferase

<400> 8
Met Phe Gln Pro Leu Leu Asp Ala Tyr Ile Asp Ser Thr Arg Leu Asp
1 5 10 15

Glu Thr Asp Tyr Lys Pro Pro Leu Asn Ile Ala Leu Ala Asn Trp Trp
20 25 30

Pro Leu Asp Lys Arg Glu Ser Lys Gly Phe Arg Lys Lys Phe Ile Leu
35 40 45

His Phe Ile Leu Ser Gln His Tyr Thr Ile Ala Leu His Arg Asn Pro
 50 55 60
 Asp Lys Pro Ala Asp Ile Val Phe Gly Asn Pro Leu Gly Ser Ala Arg
 65 70 75 80
 Lys Ile Leu Ser Tyr Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu
 85 90 95
 Asn Glu Val Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp
 100 105 110
 Glu Leu Asp Phe Arg Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr Asp
 115 120 125
 Arg Leu His His Lys Ala Glu Ser Val Asn Asp Thr Thr Ala Pro Tyr
 130 135 140
 Lys Ile Lys Ser Asp Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His
 145 150 155 160
 Phe Lys Glu Asn His Pro His Leu Cys Ala Leu Ile Asn Asn Glu Ile
 165 170 175
 Asp Pro Leu Lys Arg Gly Phe Ala Ser Phe Val Ala Ser Asn Pro Asn
 180 185 190
 Ala Pro Ile Arg Asn Ala Phe Tyr Glu Ala Leu Asn Ser Ile Glu Pro
 195 200 205
 Val Thr Gly Gly Gly Ser Val Arg Asn Thr Leu Gly Tyr Asn Val Lys
 210 215 220
 Asn Lys Asn Glu Phe Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu
 225 230 235 240
 Asn Thr Gln Gly Tyr Gly Tyr Val Thr Glu Lys Ile Ile Asp Ala Tyr
 245 250 255
 Phe Ser His Thr Ile Pro Ile Tyr Trp Gly Gly Val Pro Ser Val Ala
 260 265 270
 Lys Asp Phe Asn Pro
 275

<210> 9

<211> 276

<212> DNA

<213> *Helicobacter pylori*

<220>

<223> *Helicobacter pylori* strain 915 FutA
 alpha-1,3/4-fucosyltransferase

<400> 9

atggcctcta aatctcccc cctaaaaatc gctgtggcga attggtgggg agatgaagaa 60
 attaaaaaat ttaaaaaagag cgttctttat tttatocctaa gccagcatta cacaatcact 120
 ttacaccgaa accctgataa acctgcggac atcgtctttg gtaaccccct tggatcagcc 180
 agaaaaatct tatcctatca aaacgcaaaa aggggtgtttt acaccggtga aaatgaagtc 240
 cctaacttca acctctttga ttacgccata ggcttt 276

```
<220>
<223> Helicobacter pylori strain 915 FutA
      alpha-1,3/4-fucosyltransferase
```

```

<400> 10
Met Ala Ser Lys Ser Pro Pro Leu Lys Ile Ala Val Ala Asn Trp Trp
  1          5          10          15

Gly Asp Glu Glu Ile Lys Lys Phe Lys Lys Ser Val Leu Tyr Phe Ile
      20          25          30

Leu Ser Gln His Tyr Thr Ile Thr Leu His Arg Asn Pro Asp Lys Pro
    35          40          45

Ala Asp Ile Val Phe Gly Asn Pro Leu Gly Ser Ala Arg Lys Ile Leu
    50          55          60

Ser Tyr Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn Glu Val
    65          70          75          80

Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe
      85          90

```

```
<210> 11
<211> 1278
<212> DNA
<213> Helicobacter pylori
```

```
<220>
<223> Helicobacter pylori strain 26695 FutA
      alpha-1,3/4-fucosyltransferase
```

<400>	11						
atgttccaac	ccctattaga	cgcctttata	gaaagcgctt	ccattgaaaa	aatggcctct	60	
aaatctcccc	ccccccccct	aaaaatcgct	gtggcggaatt	gggtggggaga	tgaagaaatt	120	
aaagaattta	aaaagagcgt	tctttatfff	atcctaagcc	aacgctacgc	aatcacccctc	180	
caccaaacc	ccaatgaatt	ttcagatcta	gttttttagca	atcctctttg	agcggctaga	240	
aagattttat	cttatcaaaa	cactaaacga	gtgttttaca	cgggtgaaaa	cgaatcacct	300	
aatttcaacc	tctttgatta	cgccataggg	tttgatgaat	tggatttttaa	tgatcgttat	360	
ttgagaatgc	ctttgtatta	tgcccatftr	cactataaag	ccgagcttgt	taatgacacc	420	
actgcgcct	acaaactcaa	agacaacagc	ctttatgctt	taaaaaaacc	ctctcatcat	480	
tttaaagaaa	accaccctaa	tttgtgcgca	gtagtgaatg	atgagagcga	tcttttaaaa	540	
agagggtttg	ccagttttgt	agcgagcaac	gctaacgctc	ctatgaggaa	cgctttttat	600	
gacgctctaa	attccataga	gccagttact	gggggaggaa	gtgtgagaaa	cacttttaggc	660	
tataaggttg	gaaacaaaag	cgagttttta	agccaatata	agttcaatct	ctgttttgaa	720	
aactcgcaag	gttatggcta	tgtaaccgaa	aaaatccttg	atgcgtattt	tagccatacc	780	
attcctattt	attgggggag	tcccagcgtg	gcgaagatt	ttaaccctaa	aagttttgtg	840	
aatgtgcatg	atttcaacaa	ctttgatgaa	gcgattgatt	atatcaaata	cctgcacacg	900	
cacccaaacg	cttatftraga	catgctctat	gaaaaccctt	taaacaccct	tgatgggaaa	960	
gcttactfff	accaagattt	gagtttttaa	aaaatcctag	atfttttttaa	aacgattftta	1020	
gaaaacgata	cgattttatca	caaattctca	acatctttca	tgtgggagta	cgatctgcat	1080	
aagccgtttag	tatccattga	tgattttgagg	gttaattatg	atgattttgag	ggttaattat	1140	
gaccggcttt	tacaaaacgc	ttcgccctta	ttagaactct	ctcaaaacac	cactftttaaa	1200	
atctatcgca	aagcttatca	aaaatccttg	cctttgttgc	gcgcgggtgag	aaagttgggt	1260	
aaaaaattqg	qttttqtaa					1278	

<210> 12
 <211> 425
 <212> PRT
 <213> Helicobacter pylori

<220>
 <223> Helicobacter pylori strain 26695 FutA
 alpha-1,3/4-fucosyltransferase

<400> 12
 Met Phe Gln Pro Leu Leu Asp Ala Phe Ile Glu Ser Ala Ser Ile Glu
 1 5 10 15
 Lys Met Ala Ser Lys Ser Pro Pro Pro Pro Leu Lys Ile Ala Val Ala
 20 25 30
 Asn Trp Trp Gly Asp Glu Glu Ile Lys Glu Phe Lys Lys Ser Val Leu
 35 40 45
 Tyr Phe Ile Leu Ser Gln Arg Tyr Ala Ile Thr Leu His Gln Asn Pro
 50 55 60
 Asn Glu Phe Ser Asp Leu Val Phe Ser Asn Pro Leu Gly Ala Ala Arg
 65 70 75 80
 Lys Ile Leu Ser Tyr Gln Asn Thr Lys Arg Val Phe Tyr Thr Gly Glu
 85 90 95
 Asn Glu Ser Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp
 100 105 110
 Glu Leu Asp Phe Asn Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr Ala
 115 120 125
 His Leu His Tyr Lys Ala Glu Leu Val Asn Asp Thr Thr Ala Pro Tyr
 130 135 140
 Lys Leu Lys Asp Asn Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His
 145 150 155 160
 Phe Lys Glu Asn His Pro Asn Leu Cys Ala Val Val Asn Asp Glu Ser
 165 170 175
 Asp Leu Leu Lys Arg Gly Phe Ala Ser Phe Val Ala Ser Asn Ala Asn
 180 185 190
 Ala Pro Met Arg Asn Ala Phe Tyr Asp Ala Leu Asn Ser Ile Glu Pro
 195 200 205
 Val Thr Gly Gly Gly Ser Val Arg Asn Thr Leu Gly Tyr Lys Val Gly
 210 215 220
 Asn Lys Ser Glu Phe Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu
 225 230 235 240
 Asn Ser Gln Gly Tyr Gly Tyr Val Thr Glu Lys Ile Leu Asp Ala Tyr
 245 250 255
 Phe Ser His Thr Ile Pro Ile Tyr Trp Gly Ser Pro Ser Val Ala Lys
 260 265 270

Asp Phe Asn Pro Lys Ser Phe Val Asn Val His Asp Phe Asn Asn Phe
 275 280 285
 Asp Glu Ala Ile Asp Tyr Ile Lys Tyr Leu His Thr His Pro Asn Ala
 290 295 300
 Tyr Leu Asp Met Leu Tyr Glu Asn Pro Leu Asn Thr Leu Asp Gly Lys
 305 310 315 320
 Ala Tyr Phe Tyr Gln Asp Leu Ser Phe Lys Lys Ile Leu Asp Phe Phe
 325 330 335
 Lys Thr Ile Leu Glu Asn Asp Thr Ile Tyr His Lys Phe Ser Thr Ser
 340 345 350
 Phe Met Trp Glu Tyr Asp Leu His Lys Pro Leu Val Ser Ile Asp Asp
 355 360 365
 Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp Arg Leu Leu
 370 375 380
 Gln Asn Ala Ser Pro Leu Leu Glu Leu Ser Gln Asn Thr Thr Phe Lys
 385 390 395 400
 Ile Tyr Arg Lys Ala Tyr Gln Lys Ser Leu Pro Leu Leu Arg Ala Val
 405 410 415
 Arg Lys Leu Val Lys Lys Leu Gly Leu
 420 425

<210> 13
 <211> 45
 <212> DNA
 <213> Helicobacter pylori

<220>
 <223> Helicobacter pylori strain 19C2 FutA
 alpha-1,3/4-fucosyltransferase

<400> 13
 atgttccaac ccttactaga cgcctttata gaaagtgtc caatt

45

<210> 14
 <211> 15
 <212> PRT
 <213> Helicobacter pylori

<220>
 <223> Helicobacter pylori strain 19C2 FutA
 alpha-1,3/4-fucosyltransferase

<400> 14
 Met Phe Gln Pro Leu Leu Asp Ala Phe Ile Glu Ser Ala Pro Ile
 1 5 10 15

<210> 15
 <211> 283
 <212> PRT
 <213> Helicobacter pylori

<220>
 <223> Helicobacter pylori strain 1182 FutB
 alpha-1,3/4-fucosyltransferase amino acids 23-305,
 conserved fucosyltransferase catalytic domain

<400> 15
 Pro Pro Pro Leu Lys Ile Ala Val Ala Asn Trp Trp Gly Asp Glu Glu
 1 5 10 15
 Val Glu Glu Phe Lys Lys Asn Ile Leu Tyr Phe Ile Leu Ser Gln His
 20 25 30
 Tyr Thr Ile Thr Leu His Gln Asn Pro Asn Glu Pro Ser Asp Leu Val
 35 40 45
 Phe Gly Ser Pro Ile Gly Ser Ala Arg Lys Ile Leu Ser Tyr Gln Asn
 50 55 60
 Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn Glu Ser Pro Asn Phe Asn
 65 70 75 80
 Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu Leu Asp Phe Arg Asp Arg
 85 90 95
 Tyr Leu Arg Met Pro Leu Tyr Tyr Asp Arg Leu His His Lys Ala Glu
 100 105 110
 Ser Val Asn Asp Thr Thr Ser Pro Tyr Lys Leu Lys Pro Asp Ser Leu
 115 120 125
 Tyr Ala Leu Lys Lys Pro Ser His His Phe Lys Glu Asn His Pro Asn
 130 135 140
 Leu Cys Ala Val Val Asn Asn Glu Ser Asp Pro Leu Lys Arg Gly Phe
 145 150 155 160
 Ala Ser Phe Val Ala Ser Asn Pro Asn Ala Pro Lys Arg Asn Ala Phe
 165 170 175
 Tyr Asp Val Leu Asn Ser Ile Glu Pro Val Ile Gly Gly Gly Ser Val
 180 185 190
 Lys Asn Thr Leu Gly Tyr Asn Ile Lys Asn Lys Ser Glu Phe Leu Ser
 195 200 205
 Gln Tyr Lys Phe Asn Leu Cys Phe Glu Asn Ser Gln Gly Tyr Gly Tyr
 210 215 220
 Val Thr Glu Lys Ile Ile Asp Ala Tyr Phe Ser His Thr Ile Pro Ile
 225 230 235 240
 Tyr Trp Gly Ser Pro Ser Val Ala Gln Asp Phe Asn Pro Lys Ser Phe
 245 250 255

Val Asn Val Cys Asp Phe Lys Asp Phe Asp Glu Ala Ile Asp His Val
260 265 270

Arg Tyr Leu His Thr His Pro Asn Ala Tyr Leu
275 280

<210> 16
<211> 291
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:pfam00852,
Glyco_transf_10 consensus sequence from
glycosyltransferase family 10 fucosyltransferase
family

<400> 16
Thr Val Pro Leu Leu Leu Ala Ile Tyr Thr Trp Trp Ser Leu Ile Glu
1 5 10 15
Tyr Lys Glu Trp Lys Lys Ser Pro Ile Tyr Phe Ile Gly Ser Gln Ala
20 25 30
Pro Gln Pro Pro Leu Arg Ile Leu Leu Trp Thr Trp Pro Phe Asn Gly
35 40 45
Asn Pro Leu Ala Leu Ser Asp Cys Pro Leu Ser Tyr Gln Asn Thr Ala
50 55 60
Arg Cys Arg Leu Thr Ala Asn Arg Ser Pro Leu Glu Ser Ala Asp Ala
65 70 75 80
Val Leu Phe His His Arg Asp Leu Ser Lys Gly Phe Pro Asp Leu Pro
85 90 95
Pro Ser Pro Arg Pro Pro Gly Gln Pro Trp Val Trp Ala Ser Met Glu
100 105 110
Ser Pro Ser Asn Ser Gly Leu Asn Asp Leu Arg Asp Gly Tyr Phe Asn
115 120 125
Trp Thr Leu Ser Tyr Arg Ala Asp Ser Asp Ala Phe His Pro Tyr Gly
130 135 140
Tyr Leu Glu Pro Arg Leu Ser Gln Val Val Asn Ala Pro Leu Leu Ser
145 150 155 160
Ala Lys Arg Lys Gly Ala Ala Trp Val Val Ser Asn Cys Asn Thr Arg
165 170 175
Ser Lys Arg Glu Arg Phe Tyr Lys Gln Leu Asn Lys His Leu Gln Val
180 185 190
Asp Val Gly Gly Arg Val Ala Asn Pro Leu Pro Leu Lys Val Gly Cys
195 200 205
Leu Val Glu Thr Leu Ser Gln Tyr Lys Phe Tyr Leu Ala Phe Glu Asn
210 215 220

Ser Gln His Tyr Asp Tyr Val Thr Glu Lys Leu Trp Lys Asn Ala Leu
 225 230 235 240
 Gln Ala Gly Thr Ile Pro Val Val Leu Gly Pro Arg Ala Val Tyr Glu
 245 250 255
 Asp Phe Val Pro Pro Lys Ser Phe Ile His Val Asp Asp Phe Lys Ser
 260 265 270
 Pro Lys Glu Leu Ala Asp Tyr Leu Leu Tyr Leu Asp Thr Asn Pro Thr
 275 280 285
 Ala Tyr Ser
 290

<210> 17
 <211> 391
 <212> PRT
 <213> Helicobacter pylori

<220>
 <223> Helicobacter pylori strain 1111 FutA
 alpha-1,3/4-fucosyltransferase amino acids 27-417,
 conserved fucosyltransferase catalytic domain

<400> 17
 Ile Ala Val Ala Asn Trp Trp Gly Asp Glu Glu Ile Lys Lys Phe Lys
 1 5 10 15
 Lys Ser Val Leu Tyr Phe Ile Leu Ser Gln His Tyr Thr Ile Thr Leu
 20 25 30
 His Arg Asn Pro Asp Lys Pro Ala Asp Ile Val Phe Gly Asn Pro Leu
 35 40 45
 Gly Ser Ala Arg Lys Ile Leu Ser Tyr Gln Asn Ala Lys Arg Val Phe
 50 55 60
 Tyr Thr Gly Glu Asn Glu Val Pro Asn Phe Asn Leu Phe Asp Tyr Ala
 65 70 75 80
 Ile Gly Phe Asp Glu Leu Asp Phe Arg Asp Arg Tyr Leu Arg Met Pro
 85 90 95
 Leu Tyr Tyr Ala Tyr Leu His Tyr Lys Ala Glu Leu Val Asn Asp Thr
 100 105 110
 Thr Ser Pro Tyr Lys Leu Gln Pro Asp Ser Leu Tyr Ala Leu Lys Lys
 115 120 125
 Pro Ser His His Phe Lys Glu Asn His Pro Asn Leu Cys Ala Val Val
 130 135 140
 Asn Asn Glu Ser Asp Pro Leu Lys Arg Gly Phe Ala Ser Phe Val Ala
 145 150 155 160
 Ser Asn Pro Asn Ala Pro Arg Arg Asn Ala Phe Tyr Glu Ala Leu Asn
 165 170 175

Ala Ile Glu Pro Val Ala Gly Gly Gly Ser Val Lys Asn Thr Leu Gly
 180 185 190
 Tyr Asn Val Lys Asn Lys Ser Glu Phe Leu Ser Gln Tyr Lys Phe Asn
 195 200 205
 Leu Cys Phe Glu Asn Thr Gln Gly Tyr Gly Tyr Val Thr Glu Lys Ile
 210 215 220
 Ile Asp Ala Tyr Phe Ser His Thr Ile Pro Ile Tyr Trp Gly Ser Pro
 225 230 235 240
 Ser Val Ala Lys Asp Phe Asn Pro Lys Ser Phe Val Asn Val His Asp
 245 250 255
 Phe Asn Asn Phe Asp Glu Ala Ile Asp Tyr Ile Arg Tyr Leu His Thr
 260 265 270
 His Pro Asn Ala Tyr Leu Asp Met His Tyr Glu Asn Pro Leu Asn Thr
 275 280 285
 Ile Asp Gly Lys Ala Tyr Phe Tyr Gln Asn Leu Ser Phe Lys Lys Ile
 290 295 300
 Leu Asp Phe Phe Lys Thr Ile Leu Glu Asn Asp Thr Ile Tyr His Asp
 305 310 315 320
 Asn Pro Phe Ile Phe Tyr Arg Asp Leu Asn Glu Pro Ser Val Ser Ile
 325 330 335
 Asp Gly Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp Asp
 340 345 350
 Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Glu Arg Leu Leu
 355 360 365
 Gln Asn Ala Ser Pro Leu Leu Glu Leu Ser Gln Asn Thr Thr Phe Lys
 370 375 380
 Ile Tyr Arg Lys Ala Tyr Gln
 385 390

<210> 18

<211> 336

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:pfam00852,
 Glyco_transf_10 consensus sequence from
 glycosyltransferase family 10 fucosyltransferase
 family

<400> 18

Leu Ala Ile Tyr Thr Trp Trp Ser Leu Ile Glu Tyr Lys Glu Trp Lys
 1 5 10 15

Lys Ser Pro Ile Tyr Phe Ile Gly Ser Gln Ala Pro Gln Pro Pro Leu
 20 25 30

Arg Ile Leu Leu Trp Thr Trp Pro Phe Asn Gly Asn Pro Leu Ala Leu
 35 40 45
 Ser Asp Cys Pro Leu Ser Tyr Gln Asn Thr Ala Arg Cys Arg Leu Thr
 50 55 60
 Ala Asn Arg Ser Pro Leu Glu Ser Ala Asp Ala Val Leu Phe His His
 65 70 75 80
 Arg Asp Leu Ser Lys Gly Phe Pro Asp Leu Pro Pro Ser Pro Arg Pro
 85 90 95
 Pro Gly Gln Pro Trp Val Trp Ala Ser Met Glu Ser Pro Ser Asn Ser
 100 105 110
 Gly Leu Asn Asp Leu Arg Asp Gly Tyr Phe Asn Trp Thr Leu Ser Tyr
 115 120 125
 Arg Ala Asp Ser Asp Ala Phe His Pro Tyr Gly Tyr Leu Glu Pro Arg
 130 135 140
 Leu Ser Gln Val Val Asn Ala Pro Leu Leu Ser Ala Lys Arg Lys Gly
 145 150 155 160
 Ala Ala Trp Val Val Ser Asn Cys Asn Thr Arg Ser Lys Arg Glu Arg
 165 170 175
 Phe Tyr Lys Gln Leu Asn Lys His Leu Gln Val Asp Val Gly Gly Arg
 180 185 190
 Val Ala Asn Pro Leu Pro Leu Lys Val Gly Cys Leu Val Glu Thr Leu
 195 200 205
 Ser Gln Tyr Lys Phe Tyr Leu Ala Phe Glu Asn Ser Gln His Tyr Asp
 210 215 220
 Tyr Val Thr Glu Lys Leu Trp Lys Asn Ala Leu Gln Ala Gly Thr Ile
 225 230 235 240
 Pro Val Val Leu Gly Pro Arg Ala Val Tyr Glu Asp Phe Val Pro Pro
 245 250 255
 Lys Ser Phe Ile His Val Asp Asp Phe Lys Ser Pro Lys Glu Leu Ala
 260 265 270
 Asp Tyr Leu Leu Tyr Leu Asp Thr Asn Pro Thr Ala Tyr Ser Glu Tyr
 275 280 285
 Phe Glu Trp Arg Tyr Asp Leu Arg Val Arg Leu Phe Ser Trp Asp Ala
 290 295 300
 Leu Arg Tyr Asp Glu Gly Phe Cys Arg Val Cys Arg Leu Leu Gln Asn
 305 310 315 320
 Ala Pro Asp Arg Tyr Lys Thr Tyr Pro Asn Ile Ala Lys Trp Phe Gln
 325 330 335

<210> 19
 <211> 377
 <212> PRT
 <213> Helicobacter pylori

<220>
 <223> Helicobacter pylori strain 1218 FutB
 alpha-1,3/4-fucosyltransferase amino acids 23-399,
 conserved fucosyltransferase catalytic domain

<400> 19
 Pro Pro Pro Leu Lys Ile Ala Val Ala Asn Trp Trp Gly Asp Glu Glu
 1 5 10 15
 Val Glu Glu Phe Lys Lys Asn Ile Leu Tyr Phe Ile Leu Ser Gln His
 20 25 30
 Tyr Thr Ile Thr Leu His Gln Asn Pro Asn Glu Pro Ser Asp Leu Val
 35 40 45
 Phe Gly Ser Pro Ile Gly Ser Ala Arg Lys Ile Leu Ser Tyr Gln Asn
 50 55 60
 Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn Glu Ser Pro Asn Phe Asn
 65 70 75 80
 Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu Leu Asp Phe Arg Asp Arg
 85 90 95
 Tyr Leu Arg Met Pro Leu Tyr Tyr Asp Arg Leu His His Lys Ala Glu
 100 105 110
 Ser Val Asn Asp Thr Thr Ser Pro Tyr Lys Leu Lys Pro Asp Ser Leu
 115 120 125
 Tyr Ala Leu Lys Lys Pro Ser His His Phe Lys Glu Asn His Pro Asn
 130 135 140
 Leu Cys Ala Val Val Asn Asn Glu Ser Asp Pro Leu Lys Arg Gly Phe
 145 150 155 160
 Ala Ser Phe Val Ala Ser Asn Pro Asn Ala Pro Lys Arg Asn Ala Phe
 165 170 175
 Tyr Asp Ala Leu Asn Ser Ile Glu Pro Val Ile Gly Gly Gly Ser Val
 180 185 190
 Lys Asn Thr Leu Gly Tyr Asn Ile Lys Asn Lys Ser Glu Phe Leu Ser
 195 200 205
 Gln Tyr Lys Phe Asn Leu Cys Phe Glu Asn Ser Gln Gly Tyr Gly Tyr
 210 215 220
 Val Thr Glu Lys Ile Ile Asp Ala Tyr Phe Ser His Thr Ile Pro Ile
 225 230 235 240
 Tyr Trp Gly Ser Pro Ser Val Ala Gln Asp Phe Asn Pro Lys Ser Phe
 245 250 255
 Val Asn Val Cys Asp Phe Lys Asp Phe Asp Glu Ala Ile Asp His Val
 260 265 270

Arg Tyr Leu His Thr His Pro Asn Ala Tyr Leu Asp Met Leu Tyr Glu
275 280 285

Asn Pro Leu Asn Thr Leu Asp Gly Lys Ala Tyr Phe Tyr Gln Asn Leu
290 295 300

Ser Phe Lys Lys Ile Leu Asp Phe Phe Lys Thr Ile Leu Glu Asn Asp
305 310 315 320

Thr Ile Tyr His Asp Asn Pro Phe Ile Phe Tyr Arg Asp Leu Asn Glu
325 330 335

Pro Leu Ile Ser Ile Asp Asp Leu Arg Val Asn Tyr Asp Asp Leu Arg
340 345 350

Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn
355 360 365

Tyr Asp Asp Leu Arg Val Asn Tyr Asp
370 375

<210> 20
<211> 341
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:pfam00852,
Glyco_transf_10 consensus sequence from
glycosyltransferase family 10 fucosyltransferase
family

<400> 20
Thr Val Pro Leu Leu Leu Ala Ile Tyr Thr Trp Trp Ser Leu Ile Glu
1 5 10 15

Tyr Lys Glu Trp Lys Lys Ser Pro Ile Tyr Phe Ile Gly Ser Gln Ala
20 25 30

Pro Gln Pro Pro Leu Arg Ile Leu Leu Trp Thr Trp Pro Phe Asn Gly
35 40 45

Asn Pro Leu Ala Leu Ser Asp Cys Pro Leu Ser Tyr Gln Asn Thr Ala
50 55 60

Arg Cys Arg Leu Thr Ala Asn Arg Ser Pro Leu Glu Ser Ala Asp Ala
65 70 75 80

Val Leu Phe His His Arg Asp Leu Ser Lys Gly Phe Pro Asp Leu Pro
85 90 95

Pro Ser Pro Arg Pro Pro Gly Gln Pro Trp Val Trp Ala Ser Met Glu
100 105 110

Ser Pro Ser Asn Ser Gly Leu Asn Asp Leu Arg Asp Gly Tyr Phe Asn
115 120 125

Trp Thr Leu Ser Tyr Arg Ala Asp Ser Asp Ala Phe His Pro Tyr Gly
130 135 140

Tyr Leu Glu Pro Arg Leu Ser Gln Val Val Asn Ala Pro Leu Leu Ser
 145 150 155 160
 Ala Lys Arg Lys Gly Ala Ala Trp Val Val Ser Asn Cys Asn Thr Arg
 165 170 175
 Ser Lys Arg Glu Arg Phe Tyr Lys Gln Leu Asn Lys His Leu Gln Val
 180 185 190
 Asp Val Gly Gly Arg Val Ala Asn Pro Leu Pro Leu Lys Val Gly Cys
 195 200 205
 Leu Val Glu Thr Leu Ser Gln Tyr Lys Phe Tyr Leu Ala Phe Glu Asn
 210 215 220
 Ser Gln His Tyr Asp Tyr Val Thr Glu Lys Leu Trp Lys Asn Ala Leu
 225 230 235 240
 Gln Ala Gly Thr Ile Pro Val Val Leu Gly Pro Arg Ala Val Tyr Glu
 245 250 255
 Asp Phe Val Pro Pro Lys Ser Phe Ile His Val Asp Asp Phe Lys Ser
 260 265 270
 Pro Lys Glu Leu Ala Asp Tyr Leu Leu Tyr Leu Asp Thr Asn Pro Thr
 275 280 285
 Ala Tyr Ser Glu Tyr Phe Glu Trp Arg Tyr Asp Leu Arg Val Arg Leu
 290 295 300
 Phe Ser Trp Asp Ala Leu Arg Tyr Asp Glu Gly Phe Cys Arg Val Cys
 305 310 315 320
 Arg Leu Leu Gln Asn Ala Pro Asp Arg Tyr Lys Thr Tyr Pro Asn Ile
 325 330 335
 Ala Lys Trp Phe Gln
 340

<210> 21
 <211> 256
 <212> PRT
 <213> Helicobacter pylori

<220>
 <223> Helicobacter pylori strain 19C2 FutB
 alpha-1,3/4-fucosyltransferase amino acids 23-377,
 conserved fucosyltransferase catalytic domain

<400> 21
 Pro Pro Leu Asn Ile Ala Leu Ala Asn Trp Trp Pro Leu Asp Lys Arg
 1 5 10 15
 Glu Ser Lys Gly Phe Arg Lys Lys Phe Ile Leu His Phe Ile Leu Ser
 20 25 30
 Gln His Tyr Thr Ile Ala Leu His Arg Asn Pro Asp Lys Pro Ala Asp
 35 40 45

```

Ile Val Phe Gly Asn Pro Leu Gly Ser Ala Arg Lys Ile Leu Ser Tyr
  50              55              60

Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn Glu Val Pro Asn
  65              70              75              80

Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu Leu Asp Phe Arg
              85              90              95

Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr Asp Arg Leu His His Lys
      100              105              110

Ala Glu Ser Val Asn Asp Thr Thr Ala Pro Tyr Lys Ile Lys Ser Asp
      115              120              125

Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His Phe Lys Glu Asn His
      130              135              140

Pro His Leu Cys Ala Leu Ile Asn Asn Glu Ile Asp Pro Leu Lys Arg
      145              150              155              160

Gly Phe Ala Ser Phe Val Ala Ser Asn Pro Asn Ala Pro Ile Arg Asn
              165              170              175

Ala Phe Tyr Glu Ala Leu Asn Ser Ile Glu Pro Val Thr Gly Gly Gly
      180              185              190

Ser Val Arg Asn Thr Leu Gly Tyr Asn Val Lys Asn Lys Asn Glu Phe
      195              200              205

Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu Asn Thr Gln Gly Tyr
      210              215              220

Gly Tyr Val Thr Glu Lys Ile Ile Asp Ala Tyr Phe Ser His Thr Ile
      225              230              235              240

Pro Ile Tyr Trp Gly Gly Val Pro Ser Val Ala Lys Asp Phe Asn Pro
      245              250              255

```

```

<210> 22
<211> 259
<212> PRT
<213> Artificial Sequence

```

```

<220>
<223> Description of Artificial Sequence:pfam00852,
      Glyco_transf_10 consensus sequence from
      glycosyltransferase family 10 fucosyltransferase
      family

```

```

<400> 22
Val Pro Leu Leu Leu Ala Ile Tyr Thr Trp Trp Ser Leu Ile Glu Tyr
  1              5              10              15

Lys Glu Trp Lys Lys Ser Pro Ile Tyr Phe Ile Gly Ser Gln Ala Pro
      20              25              30

Gln Pro Pro Leu Arg Ile Leu Leu Trp Thr Trp Pro Phe Asn Gly Asn
      35              40              45

```

Pro Leu Ala Leu Ser Asp Cys Pro Leu Ser Tyr Gln Asn Thr Ala Arg
 50 55 60
 Cys Arg Leu Thr Ala Asn Arg Ser Pro Leu Glu Ser Ala Asp Ala Val
 65 70 75 80
 Leu Phe His His Arg Asp Leu Ser Lys Gly Phe Pro Asp Leu Pro Pro
 85 90 95
 Ser Pro Arg Pro Pro Gly Gln Pro Trp Val Trp Ala Ser Met Glu Ser
 100 105 110
 Pro Ser Asn Ser Gly Leu Asn Asp Leu Arg Asp Gly Tyr Phe Asn Trp
 115 120 125
 Thr Leu Ser Tyr Arg Ala Asp Ser Asp Ala Phe His Pro Tyr Gly Tyr
 130 135 140
 Leu Glu Pro Arg Leu Ser Gln Val Val Asn Ala Pro Leu Leu Ser Ala
 145 150 155 160
 Lys Arg Lys Gly Ala Ala Trp Val Val Ser Asn Cys Asn Thr Arg Ser
 165 170 175
 Lys Arg Glu Arg Phe Tyr Lys Gln Leu Asn Lys His Leu Gln Val Asp
 180 185 190
 Val Gly Gly Arg Val Ala Asn Pro Leu Pro Leu Lys Val Gly Cys Leu
 195 200 205
 Val Glu Thr Leu Ser Gln Tyr Lys Phe Tyr Leu Ala Phe Glu Asn Ser
 210 215 220
 Gln His Tyr Asp Tyr Val Thr Glu Lys Leu Trp Lys Asn Ala Leu Gln
 225 230 235 240
 Ala Gly Thr Ile Pro Val Val Leu Gly Pro Arg Ala Val Tyr Glu Asp
 245 250 255
 Phe Val Pro

<210> 23
 <211> 245
 <212> PRT
 <213> Helicobacter pylori

<220>
 <223> Helicobacter pylori strain 1111 FutA
 alpha-1,3/4-fucosyltransferase

<400> 23
 Met Phe Gln Pro Leu Leu Asp Ala Phe Ile Glu Ser Ala Pro Leu Lys
 1 5 10 15
 Lys Trp Pro Leu Asn Leu Pro Pro Leu Lys Ile Ala Val Ala Asn Trp
 20 25 30
 Trp Gly Asp Glu Glu Ile Lys Lys Phe Lys Lys Ser Val Leu Tyr Phe
 35 40 45

Ile Leu Ser Gln His Tyr Thr Ile Thr Leu His Arg Asn Pro Asp Lys
 50 55 60
 Pro Ala Asp Ile Val Phe Gly Asn Pro Leu Gly Ser Ala Arg Lys Ile
 65 70 75 80
 Leu Ser Tyr Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn Glu
 85 90 95
 Val Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu Leu
 100 105 110
 Asp Phe Arg Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr Ala Tyr Leu
 115 120 125
 His Tyr Lys Ala Glu Leu Val Asn Asp Thr Thr Ser Pro Tyr Lys Leu
 130 135 140
 Gln Pro Asp Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His Phe Lys
 145 150 155 160
 Glu Asn His Pro Asn Leu Cys Ala Val Val Asn Asn Glu Ser Asp Pro
 165 170 175
 Leu Lys Arg Gly Phe Ala Ser Phe Val Ala Ser Asn Pro Asn Ala Pro
 180 185 190
 Arg Arg Asn Ala Phe Tyr Glu Ala Leu Asn Ala Ile Glu Pro Val Ala
 195 200 205
 Gly Gly Gly Ser Val Lys Asn Thr Leu Gly Tyr Asn Val Lys Asn Lys
 210 215 220
 Ser Glu Phe Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu Asn Thr
 225 230 235 240
 Gln Gly Tyr Gly Tyr
 245

<210> 24
 <211> 247
 <212> PRT
 <213> *Helicobacter pylori*

<220>
 <223> *Helicobacter pylori* strain 26695 FutA
 alpha-1,3/4-fucosyltransferase

<400> 24
 Met Phe Gln Pro Leu Leu Asp Ala Phe Ile Glu Ser Ala Ser Ile Glu
 1 5 10 15
 Lys Met Ala Ser Lys Ser Pro Pro Pro Pro Leu Lys Ile Ala Val Ala
 20 25 30
 Asn Trp Trp Gly Asp Glu Glu Ile Lys Glu Phe Lys Lys Ser Val Leu
 35 40 45
 Tyr Phe Ile Leu Ser Gln Arg Tyr Ala Ile Thr Leu His Gln Asn Pro
 50 55 60

Asn Glu Phe Ser Asp Leu Val Phe Ser Asn Pro Leu Gly Ala Ala Arg
 65 70 75 80
 Lys Ile Leu Ser Tyr Gln Asn Thr Lys Arg Val Phe Tyr Thr Gly Glu
 85 90 95
 Asn Glu Ser Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp
 100 105 110
 Glu Leu Asp Phe Asn Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr Ala
 115 120 125
 His Leu His Tyr Lys Ala Glu Leu Val Asn Asp Thr Thr Ala Pro Tyr
 130 135 140
 Lys Leu Lys Asp Asn Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His
 145 150 155 160
 Phe Lys Glu Asn His Pro Asn Leu Cys Ala Val Val Asn Asp Glu Ser
 165 170 175
 Asp Leu Leu Lys Arg Gly Phe Ala Ser Phe Val Ala Ser Asn Ala Asn
 180 185 190
 Ala Pro Met Arg Asn Ala Phe Tyr Asp Ala Leu Asn Ser Ile Glu Pro
 195 200 205
 Val Thr Gly Gly Gly Ser Val Arg Asn Thr Leu Gly Tyr Lys Val Gly
 210 215 220
 Asn Lys Ser Glu Phe Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu
 225 230 235 240
 Asn Ser Gln Gly Tyr Gly Tyr
 245

<210> 25
 <211> 246
 <212> PRT
 <213> *Helicobacter pylori*

<220>
 <223> *Helicobacter pylori* strain 1182 FutB
 alpha-1,3/4-fucosyltransferase

<400> 25
 Met Phe Gln Pro Leu Leu Asp Ala Tyr Ile Glu Ser Ala Ser Ile Glu
 1 5 10 15
 Lys Ile Thr Ser Lys Ser Pro Pro Pro Leu Lys Ile Ala Val Ala Asn
 20 25 30
 Trp Trp Gly Asp Glu Glu Val Glu Glu Phe Lys Lys Asn Ile Leu Tyr
 35 40 45
 Phe Ile Leu Ser Gln His Tyr Thr Ile Thr Leu His Gln Asn Pro Asn
 50 55 60
 Glu Pro Ser Asp Leu Val Phe Gly Ser Pro Ile Gly Ser Ala Arg Lys
 65 70 75 80

Ile Leu Ser Tyr Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn
 85 90 95
 Glu Ser Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu
 100 105 110
 Leu Asp Phe Arg Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr Asp Arg
 115 120 125
 Leu His His Lys Ala Glu Ser Val Asn Asp Thr Thr Ser Pro Tyr Lys
 130 135 140
 Leu Lys Pro Asp Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His Phe
 145 150 155 160
 Lys Glu Asn His Pro Asn Leu Cys Ala Val Val Asn Asn Glu Ser Asp
 165 170 175
 Pro Leu Lys Arg Gly Phe Ala Ser Phe Val Ala Ser Asn Pro Asn Ala
 180 185 190
 Pro Lys Arg Asn Ala Phe Tyr Asp Val Leu Asn Ser Ile Glu Pro Val
 195 200 205
 Ile Gly Gly Gly Ser Val Lys Asn Thr Leu Gly Tyr Asn Ile Lys Asn
 210 215 220
 Lys Ser Glu Phe Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu Asn
 225 230 235 240
 Ser Gln Gly Tyr Gly Tyr
 245

<210> 26
 <211> 246
 <212> PRT
 <213> Helicobacter pylori

<220>
 <223> Helicobacter pylori strain 1218 FutB
 alpha-1,3/4-fucosyltransferase

<400> 26
 Met Phe Gln Pro Leu Leu Asp Ala Tyr Ile Glu Ser Ala Ser Ile Glu
 1 5 10 15
 Lys Ile Thr Ser Lys Ser Pro Pro Pro Leu Lys Ile Ala Val Ala Asn
 20 25 30
 Trp Trp Gly Asp Glu Glu Val Glu Glu Phe Lys Lys Asn Ile Leu Tyr
 35 40 45
 Phe Ile Leu Ser Gln His Tyr Thr Ile Thr Leu His Gln Asn Pro Asn
 50 55 60
 Glu Pro Ser Asp Leu Val Phe Gly Ser Pro Ile Gly Ser Ala Arg Lys
 65 70 75 80
 Ile Leu Ser Tyr Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn
 85 90 95

Glu Ser Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu
 100 105 110
 Leu Asp Phe Arg Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr Asp Arg
 115 120 125
 Leu His His Lys Ala Glu Ser Val Asn Asp Thr Thr Ser Pro Tyr Lys
 130 135 140
 Leu Lys Pro Asp Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His Phe
 145 150 155 160
 Lys Glu Asn His Pro Asn Leu Cys Ala Val Val Asn Asn Glu Ser Asp
 165 170 175
 Pro Leu Lys Arg Gly Phe Ala Ser Phe Val Ala Ser Asn Pro Asn Ala
 180 185 190
 Pro Lys Arg Asn Ala Phe Tyr Asp Ala Leu Asn Ser Ile Glu Pro Val
 195 200 205
 Ile Gly Gly Gly Ser Val Lys Asn Thr Leu Gly Tyr Asn Ile Lys Asn
 210 215 220
 Lys Ser Glu Phe Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu Asn
 225 230 235 240
 Ser Gln Gly Tyr Gly Tyr
 245

<210> 27

<211> 247

<212> PRT

<213> *Helicobacter pylori*

<220>

<223> *Helicobacter pylori* strain 19C2 FutB
 alpha-1,3/4-fucosyltransferase

<400> 27

Met Phe Gln Pro Leu Leu Asp Ala Tyr Ile Asp Ser Thr Arg Leu Asp
 1 5 10 15

Glu Thr Asp Tyr Lys Pro Pro Leu Asn Ile Ala Leu Ala Asn Trp Trp
 20 25 30

Pro Leu Asp Lys Arg Glu Ser Lys Gly Phe Arg Lys Lys Phe Ile Leu
 35 40 45

His Phe Ile Leu Ser Gln His Tyr Thr Ile Ala Leu His Arg Asn Pro
 50 55 60

Asp Lys Pro Ala Asp Ile Val Phe Gly Asn Pro Leu Gly Ser Ala Arg
 65 70 75 80

Lys Ile Leu Ser Tyr Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu
 85 90 95

Asn Glu Val Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp
 100 105 110

Glu Leu Asp Phe Arg Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr Asp
 115 120 125
 Arg Leu His His Lys Ala Glu Ser Val Asn Asp Thr Thr Ala Pro Tyr
 130 135 140
 Lys Ile Lys Ser Asp Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His
 145 150 155 160
 Phe Lys Glu Asn His Pro His Leu Cys Ala Leu Ile Asn Asn Glu Ile
 165 170 175
 Asp Pro Leu Lys Arg Gly Phe Ala Ser Phe Val Ala Ser Asn Pro Asn
 180 185 190
 Ala Pro Ile Arg Asn Ala Phe Tyr Glu Ala Leu Asn Ser Ile Glu Pro
 195 200 205
 Val Thr Gly Gly Gly Ser Val Arg Asn Thr Leu Gly Tyr Asn Val Lys
 210 215 220
 Asn Lys Asn Glu Phe Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu
 225 230 235 240
 Asn Thr Gln Gly Tyr Gly Tyr
 245

<210> 28
 <211> 13
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

<400> 28
 Met Phe Gln Pro Leu Leu Asp Ala Phe Ile Glu Ser Ala
 1 5 10

<210> 29
 <211> 16
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

<400> 29
 Pro Pro Leu Lys Ile Ala Val Ala Asn Trp Trp Gly Asp Glu Glu Ile
 1 5 10 15

<210> 30
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
pylori alpha-1,3/4-fucosyltransferase consensus
sequence

<400> 30
Ile Leu Tyr Phe Ile Leu Ser Gln His Tyr Thr Ile Thr Leu His
1 5 10 15

<210> 31
<211> 32
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
pylori alpha-1,3/4-fucosyltransferase consensus
sequence

<400> 31
Pro Ala Asp Ile Val Phe Gly Asn Pro Leu Gly Ser Ala Arg Lys Ile
1 5 10 15

Leu Ser Tyr Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn Glu
20 25 30

<210> 32
<211> 28
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
pylori alpha-1,3/4-fucosyltransferase consensus
sequence

<400> 32
Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu Leu Asp
1 5 10 15

Phe Arg Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr
20 25

<210> 33
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
pylori alpha-1,3/4-fucosyltransferase consensus
sequence

<400> 33
 Leu His His Lys Ala Glu
 1 5

<210> 34
 <211> 11
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

<400> 34
 Val Asn Asp Thr Thr Ser Pro Tyr Lys Leu Lys
 1 5 10

<210> 35
 <211> 46
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

<400> 35
 Asp Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His Phe Lys Glu Asn
 1 5 10 15

His Pro Asn Leu Cys Ala Val Val Asn Asn Glu Ser Asp Pro Leu Lys
 20 25 30

Arg Gly Phe Ala Ser Phe Val Ala Ser Asn Pro Asn Ala Pro
 35 40 45

<210> 36
 <211> 14
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

<400> 36
 Arg Asn Ala Phe Tyr Asp Ala Leu Asn Ser Ile Glu Pro Val
 1 5 10

<210> 37
 <211> 37
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter pylori alpha-1,3/4-fucosyltransferase consensus sequence

<400> 37
 Gly Gly Gly Ser Val Lys Asn Thr Leu Gly Tyr Asn Val Lys Asn Lys
 1 5 10 15
 Ser Glu Phe Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu Asn Ser
 20 25 30
 Gln Gly Tyr Gly Tyr
 35

<210> 38
 <211> 333
 <212> DNA
 <213> Helicobacter pylori

<220>
 <223> Helicobacter pylori strain 915 FutA (915A.cod (MWG)) alpha-1,3/4-fucosyltransferase

<400> 38
 atgttccaac ccctattaga tgcctttata gaaagcgctt ccattgaaaa aatggcctct 60
 aaatctcccc ccctaaaaat cgctgtggcg aattggtggg gagatgaaga aattaaaaaa 120
 tttaaaaaga gogttcttta tttatccta agccagcatt acacaatcac tttacaccga 180
 aacctgata aacctgcgga catcgtcttt ggtaaccccc ttggatcagc cagaaaaatc 240
 ttatcctatc aaaacgcaaa aagggtgttt tacaccggtg aaaatgaagt ccctaacttc 300
 aacctctttg attacgccat aggcttttga tga 333

<210> 39
 <211> 53
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter pylori alpha-1,3/4-fucosyltransferase consensus sequence

<400> 39
 atgttccaac ccctattaga cgcctttata gaaagcgctt ccattgaaaa aat 53

<210> 40
 <211> 20
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter pylori alpha-1,3/4-fucosyltransferase consensus sequence

<400> 40
 gcctctaaat ctcccccccc 20

<210> 41
 <211> 26
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 41
 taaaaatcgc tgtggcgaat tgggtg 26

 <210> 42
 <211> 23
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 42
 agaaattaaa gaatttaaaa aga 23

 <210> 43
 <211> 17
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 43
 cagcattaca caatcac 17

 <210> 44
 <211> 10
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 44
 tcgtcttttg 10

 <210> 45
 <211> 44
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter pylori alpha-1,3/4-fucosyltransferase consensus sequence

<400> 45
 cttggatcag ccagaaaaat cttatcctat caaaacgcaa aaag 44

<210> 46
 <211> 24
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter pylori alpha-1,3/4-fucosyltransferase consensus sequence

<400> 46
 gtgttttaca ccggtgaaaa cgaa 24

<210> 47
 <211> 36
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter pylori alpha-1,3/4-fucosyltransferase consensus sequence

<400> 47
 cctaatttca acctctttga ttacgccata ggcttt 36

<210> 48
 <211> 11
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter pylori alpha-1,3/4-fucosyltransferase consensus sequence

<400> 48
 gatgaattgg a 11

<210> 49
 <211> 17
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter pylori alpha-1,3/4-fucosyltransferase consensus sequence

<400> 49 tttagagatc gttat	17
<210> 50 <211> 11 <212> DNA <213> Artificial Sequence	
<220> <223> Description of Artificial Sequence:Helicobacter pylori alpha-1,3/4-fucosyltransferase consensus sequence	
<400> 50 agaatgcctt t	11
<210> 51 <211> 11 <212> DNA <213> Artificial Sequence	
<220> <223> Description of Artificial Sequence:Helicobacter pylori alpha-1,3/4-fucosyltransferase consensus sequence	
<400> 51 ataaagccga g	11
<210> 52 <211> 12 <212> DNA <213> Artificial Sequence	
<220> <223> Description of Artificial Sequence:Helicobacter pylori alpha-1,3/4-fucosyltransferase consensus sequence	
<400> 52 aatgacacca ct	12
<210> 53 <211> 17 <212> DNA <213> Artificial Sequence	
<220> <223> Description of Artificial Sequence:Helicobacter pylori alpha-1,3/4-fucosyltransferase consensus sequence	
<400> 53 cgcttacaa actcaaa	17

<210> 54
 <211> 55
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 54
 ctgacagcct ttatgcttta aaaaaaccct cccatcattt taaagaaaac caccc 55

 <210> 55
 <211> 14
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 55
 tgcgcagtag tgaa 14

 <210> 56
 <211> 35
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 56
 aatgagagcg atccttttgaa aagagggttt gcgag 35

 <210> 57
 <211> 19
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 57
 agcaacccta acgctccta 19

 <210> 58
 <211> 14
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 58
 gcttttaaatt ctat 14

 <210> 59
 <211> 10
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 59
 gagccagtta 10

 <210> 60
 <211> 17
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 60
 tgggggaggg agcgtga 17

 <210> 61
 <211> 18
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 61
 aaacacttta ggctataa 18

 <210> 62
 <211> 23
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

<400> 62
 agcgagtttt taagccaata caa 23

<210> 63
 <211> 21
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

<400> 63
 ttcaatctgt gttttgaaaa c 21

<210> 64
 <211> 41
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

<400> 64
 caaggctatg gctatgtaac tgaaaaaatc attgacgctt a 41

<210> 65
 <211> 27
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

<400> 65
 agccatacca ttcctattta ttggggg 27

<210> 66
 <211> 16
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

<400> 66
 aagattttaa ccctaa 16

<210> 67
 <211> 14
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 67
 agttttgtga atgt 14

 <210> 68
 <211> 17
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 68
 tttgatgaag cgattga 17

 <210> 69
 <211> 33
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 69
 tgcacacgca cccaaacgct tatttagaca tgc 33

 <210> 70
 <211> 20
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

 <400> 70
 tatgaaaacc ctttaaacac 20

 <210> 71
 <211> 26
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

<400> 71
 ttgatgggaa agcttacttt taccaa 26

<210> 72
 <211> 40
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

<400> 72
 atttgagttt taaaaaaatc ctagattttt ttaaaacgat 40

<210> 73
 <211> 11
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

<400> 73
 ttagaaaacg a 11

<210> 74
 <211> 38
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:Helicobacter
 pylori alpha-1,3/4-fucosyltransferase consensus
 sequence

<400> 74
 ttgagggtta attatgatga tttgagggtt aattatga 38

<210> 75
 <211> 8
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:FLAG tag
 epitope tag

<400> 75
Asp Tyr Lys Asp Asp Asp Asp Lys
1 5

<210> 76
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:hexahistidine
affinity tag, purification tag

<400> 76
His His His His His His
1 5